Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

BULLETIN

OF THE

TORREY BOTANICAL CLUB.

Vol. XX. Lancaster, Pa., October 20, 1893. No. 10.

Contribution to the Probable Biology of Plasomen.

By Albert Schneider.

It is only for few years that the theory of the cell unit has been wholly exploded. Since then many valuable discoveries have been made in regard to cell structure. Brücke, Altmann, Hartig, Nägeli, Flemming, Stricker, Strassburger, Guignard, Schmitz, Berthold, Boveri, Bütchli and Wiesner are a few of the leading scientists who have made valuable contributions to cytology. We must, however, not forget workers of lesser note whose contributions in the aggregate are indeed of great value.

Scientists are now agreed that the cell, which has been heretofore considered the ultimate unit of structure, is made up of a multitude of simpler units combining to form, so to speak, cell organs, as cell wall, chromoplastids, cell granules, chromotin threads, nucleoli, etc. All efforts to show that protoplasm (cytoplasm) is a homogeneous substance with a definite arrangement have been futile. Among the recent workers, Bütchli has endeavored to show that cytoplasm always has a reticulated (wabenartige) structure. That such a structure is often noticeable is certainly true. It is likewise true that often such a structure is not noticeable. Such efforts, especially when too strongly prompted to conform to some preconcieved notion, lead to no good results, but rather create scientific distrust and confusion.

That cytoplasm is not a homogeneous substance is now generally accepted. It is supposed to be made up of a multitude of ultimate living units of structure. Wiesner has probably formulated the most plausible theory in regard to these ultimate units which he has designated plasomen. The plasomen, like Nägeli's micellæ, have thus far only a hypothetical existence. The following is a brief summary of Wiesner's reasons for assuming the existence of plasomen.

1. The more or less constant presence of organized individuals (nucleus, plastids, etc.) in the cell teaches conclusively that the cell cannot be the ultimate unit of living structures.

2. Since all organized individuals of the cell originate from similar organized individuals, through division, it is to be supposed that all organized bodies found within the cell are not formed spontaneously but through fission.

3. Mitosis teaches that the nucleus as well as cytoplasm consists of autodivisible organic individuals. From this we are induced to conclude that the nucleus and cytoplasm are not the ultimate units of structure, but that *they* are built up of ultimate units. The origin and development of the cell wall indicates that it is also made up of ultimate units.

4. Autodivision within the cell goes beyond the limits of direct observation. A limit to the divisibility of living substance must exist. These last divisible living bodies of the cell are to be considered the ultimate units of structure (elementarorganismen). These ultimate units Wiesner designates plasomen.

5. Plasomen have above all the power to divide, and since they divide continuously up to a certain limit they must also have the power to grow; but growth necessitates assimilation; hence divisibility, growth and assimilation are preëminently the properties of plasomen.

6. Organic cell individuals (nucleus, plastids, cell wall, dermatosomen, etc.) are plasom aggregates. Cytoplasm is simply a multitude of undifferentiated plasomen.

7. Growth of cytoplasm, of cell wall, nuclei, plastids, takes place as does the growth of many-celled organisms; the latter grow as the result of cell growth and division, the former as the result of plasom division and growth.

It is not my intention to discuss or explain Wiesner's theory, but rather to give what I hold to be additional evidence as to the correctness of his assumptions. While examining root tubercles of *Cycas revoluta* I noticcd that the palisade layer cells contained many rather large cytoplasmic granules (dermatosomen, zell granula, elementarorganismen, etc.). They are highly refractive, spherical in shape, and in size varying, beginning at the limits of of observation to one half mikron (μ) in diameter; a few are as much as one μ in diameter. Only the larger ones were noticeable with the objectives at my disposal (Zeiss 2.0 mm. hom. imm. ap. 140). On the addition of aqueous cor. sub. solution ($\frac{1}{100}$ per cent.) they took on a dark stain and were brought to view very much better. It was seen that the protoplasm was made up of granules of all sizes up to the limit given. Most of the aniline dyes stain them more or less. To my knowledge nothing is superior to the above mentioned sublimate solution. In the case of *Cycas* root tubercles it seems to answer much better than Altmann's method, which consists in adding alcoholic sublimate solution followed by acid fuchsin stain. The fact that I noticed quite a number of hourglass forms led me to suppose that they underwent division, though Wiesner states that they probably have lost the power to do so. I made some culture experiments, not with the expectation of developing a culture of plasomen, but rather, if possible, to study their vitality outside of the cell. Cycad tubercles were carefully washed, then dried quickly by means of blotting paper which had been passed through the flame of a Bunsen burner; then the tubercle itself was passed through the flame so as to singe it on all sides. With a sterilized knife the dermal layer was cut down one side and the tubercle broken (not cut) across. The inoculations were then made from the green palisade layer upon various agar-veg. extract media. The inoculated tubes were then placed in a dark incubator at a constant temperature of 35° C. After from three to five days a small growth was noticed in most tubes at points of inoculation. Examination showed the presence of cocci and bacteria. Treating with aqueous sub. sol. showed also the presence of plasomen. These were introduced with the inoculating needle and became more or less intermixed with the cocci and bacteria culture. I made repeated examinations of these cultures at intervals of several days, always finding a few plasomen. After a period of three or four weeks I was no longer able to detect any. In a few tubes there was no development of bacteria. In these I could study the plasomen unobstructed. There was no visible growth, but examination showed the unmistakable presence of the plasomen. After a time more mature plasomen (dermatosomen) were noticeable, and these mature plasomen were evidently present in greater numbers than when the inoculation was made. In about three weeks from the time of inoculation the plasomen were nearly all mature, often united into small zoöglœ. I do not intend to state that all the plasomen, visible and invisible, introduced with the inoculating needle developed to maturity, since it is impossible even to conjecture the number introduced. I was at first inclined to ignore them, thinking they were probably by-products of the bacteria and cocci. But their presence in inoculated tubes containing no bacteria, and their behavior with sublimate solution indicated that they were true Plasomen. I also made plasom cultures from developing tubers of *Solanum tuberosum* and growing roots of *Zea Mays* with similar results. In all cases there was for a time an apparent increase in the number of mature plasomen coinciding with a decrease in number of the smaller plasomen; later only mature plasomen were present, and finally these decreased in number until all had disappeared. In the case where entire cells were inoculated it was plainly noticeable that the mature plasomen increased somewhat in number until finally the cell contained only those developed to maturity. This phenomenon is also often noticeable in bacterial cells and cells of hyphal fungi found in culture media. The probably correct explanation of these phenomena is as follows: The plasomen of Wiesner have a veritable existence and are capable of developing into mature dermatosomen outside of the living cell. The plasomen can, however, not divide outside of the living cell. The reason for this latter supposition is that the dermatosomen do not continue to exist. The apparent reproduction or increase in number is due to the growth of the invisible plasomen to visible dermatosomen. As soon as all plasomen capable of growth have reached maturity apparent reproduction ceases, and the dermatosomen begin to decrease in number as they are scattered through the culture medium or become disorganized.

Cramer has observed the growth of cell walls of certain Siphonaceæ when separated from the living cytoplasm. Numerous other observations have been made to demonstrate that the cell wall of many plants is built up of living plasomen capable of considerable growth. Pfeffer and others are therefore far from right when they term the cell wall a dead substance.

The question whether cytoplasm, or to use a more correct expression, plasomen can be induced to divide outside of the living cell may be settled before very long. I believe it to be only a question of environment, and not a question of germ-plasm, as Wiesner and others seem to think.

UNIVERSITY OF ILLINOIS, CHAMPAIGN, ILL.

Bibliography.

Altmann—Elementarorganismen, 1890.
Altmann—Die Genese der Zelle, 1887.
Askenasy—Ber. d. deutsch. bot. Ges., Bd. VIII. 1890.
Berthold—Studien über Proloplasmamechanic, 1887.
Billroth—Gegenwirkung der Pflanzen-und Thierzellen, 1890.
Boveri—Zellstudien, 1887.
Brücke—Die Elementarorganismen, 1861.
Bütschli—Protoplasmische Schäume, 1892.
Bütschli—Biolog. Centralbl., Bd. VIII. 1888.
Cramer—Denkschrif. d. Schweiz. naturf. Ges., Bd. XXX. 1887; Bd. XXXII. 1890.
Errera—Ber. d. deutsch. bot. Ges., Bd. IV. 1886.
Flemming—Zellsubstanz. 1882.
Hanstein—Einge Züge aus der Biologie des Protoplasmas, 1880.
Ljukanou—Grundzüge einer Allgemeiner Pathologie der Zelle, 1891.
Mikosch—Sitz. d. Kais. Ak. d. Wissensch., Bd. XCII. 1885.
Nägeli—Ak. d. Wissensch. zu München, Heft 4, 1881.
Pfeffer—Pflanzenphysiologie, 1881.
Pfitzer—Morph. Jahrbuch., 1881.
Schimper—Ann. des. Sci. nat., Nr. 3, 1881.
Schmitz—Die Chromatophoren der algen., 1882.
Schmitz—Über die Structur des Protoplasmas und des Zellkernes der Pflanzenzelle, 1880.
Schwarz—Cohn's Beiträge zur Biologie der Pflanzen, Bd. IV. 1887.
Van Tieghem—Traité de bot. 1884.
Wiesner—Anatomie and Physiolog. d. Pflanzen, 1881.
Wiesner—Ber. d. deutsch. bot. Ges., Heft 7, 1890.
Wiesner—Elementarstructur, 1892.
Zacharias—Ber. d. deutsch. bot. Ges., Heft 5, 1893.
Zimmermann—Beiträge zur Morph. and Phys. der Pflanzenzelle, Heft 1, 1890.